A Patient in Respiratory Distress After Esophagectomy

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We present the case of a woman in her 40s who underwent a McKeown esophagectomy for the treatment of proximal to middle esophageal squamous cell carcinoma after treatment with neoadjuvant chemotherapy and radiation therapy. This extensive procedure included a right-sided thoracotomy, total thoracic esophagectomy, gastric mobilization, development of gastric conduit with pyloroplasty to facilitate gastric emptying, and finally substernal placement of the gastric conduit (gastric pull-up) with anastomosis to the cervical esophagus. A nasogastric tube (NGT) was placed for gastric decompression, and a feeding jejunostomy tube was inserted for early feeding. The NGT was removed on postoperative day 3. Two chest tubes inserted intraoperatively were removed on postoperative day 4.

On the fifth postoperative day, the patient had tachycardia and hypoxia. Chest CT scan showed right middle and lower lobe pneumonia with an adjacent pleural effusion, collection of fluid and gas in the posterior mediastinum adjacent to surgical clips thought to be postsurgical changes, and a small left hydropneumothorax with lower lobe atelectasis. No

Figure 1 – Chest radiograph (postoperative day 9) demonstrating a moderate left hydropneumothorax with left lower lobe atelectasis, right lower lung consolidation, persistent postsurgical changes of esophagectomy, and left upper abdomen prominent loop of bowel.

comment was made regarding the patient's abdomen. Treatment included supplemental oxygen, antimicrobials, and right thoracentesis. On postoperative day 6, she developed abdominal distention. An abdominal film revealed a dilated loop of descending large intestine (9.3 cm in largest diameter). Jejunostomy tube feedings were stopped, and suppositories were given for presumed ileus.

The rapid response system was activated by the patient's bedside nurse on postoperative day 9 after an episode of bilious emesis accompanied with respiratory insufficiency, hypoxia, and hemodynamic instability. She was treated with high-flow nasal cannula at 0.9 FIO₂ and IV fluids. Subsequently, her hemodynamics and oxygen saturation improved; however, her work of breathing remained labored. Chest radiograph demonstrated unchanged small left hydropneumothorax

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with left lower lobe atelectasis, unchanged right lower lung consolidation, persistent postoperative surgical changes, and unchanged left upper abdomen prominent loop of bowel ([Fig 1](#)). Emergent endotracheal intubation was considered.

Focused cardiac ultrasound showed grossly normal left and right ventricle size and function with no pericardial pathology. While obtaining the apical four-chamber view, a notable finding was discovered while scanning the left midclavicular region around the third and fourth intercostal space ([Videos 1, 2](#)).

Question: What finding was demonstrated in the point-of-care ultrasound images obtained?

Answer: A distended stomach with echogenic gastric contents and air bubbles in the left hemithorax.

Discussion

Peri-intubation aspiration (PIA) of gastric contents may lead to aspiration pneumonia or pneumonitis with associated poor outcomes.¹ Patients undergoing emergent endotracheal intubations are at an increased risk for PIA because the typical preanesthesia fasting preparation for elective procedures is not possible.¹ The usefulness of gastric ultrasonography, in addition to standard preanesthesia assessment, for risk stratification of patients with potential for aspiration by anesthesiologists has been studied in prospective and retrospective analyses.¹⁻³ Investigators have found that the ultrasonographic findings influenced the timing of the operative procedure or the anesthetic management.¹⁻³ A systematic review recommended the addition of gastric ultrasonography to standard preanesthesia assessment specifically for patients who have not followed fasting instructions, are unable to be nothing by mouth, or have conditions that alter their gastric motility.⁴

To our knowledge, only one study has described the use of critical care-based gastric point-of-care ultrasound (POCUS) to identify large volume gastric fluid prior to emergent intubation.⁵ Koenig et al⁵ used a qualitative sonographic assessment of a fluid-filled stomach; no attempts were made to quantify the gastric volume. Peri-intubation gastric POCUS performed on 80 patients who were critically ill noted that 19 (24%) of them had identifiable gastric contents. Of these, 5 (26%) had a gastric fluid amount that was deemed inconsequential for intervention, and 14 (74%) had sufficient gastric volume warranting NGT insertion. The authors noted the examination is fast (average time < 2 min) and easy to perform; however, there is a concern for false-negative examinations because of patient body habitus, postoperative dressings, gastric or colonic air, and operator experience.⁵

In the presented patient, we found a hypoechoic structure with echogenic materials and air bubbles within the chest while performing a cardiac POCUS. A contracting heart is observed superior to this hypoechoic structure. When correlated with the patient's clinical history, and reexamining the patient's portable chest radiograph (Fig 1), there appears to be a hyperechoic structure consistent with thick stomach wall, encasing hypoechoic material consistent with fluid with echogenic material within, suggestive of stomach contents and air

bubbles (Videos 1 and 2). The position of the phased array probe was around the left midaxillary line at the third and fourth intercostal space, which is higher than the gastric POCUS scanning position described by Koenig et al.⁵ This is because of the patient's altered internal anatomy after a gastric conduit pull-up surgical procedure.⁶

This POCUS finding could potentially be interpreted as a complex pleural effusion because of the probe location and similarity of ultrasound appearance of gastric fluid and complex pleural fluid. However, the noted echogenic structure does not contain dynamic lung findings, and the echogenic material is encased by what appears to be the stomach wall. The summation of these POCUS findings together with chest radiographic findings and the recent surgical procedure made it less likely to be a complex pleural effusion (Discussion Video) Therefore, it was decided to insert an NGT to decompress the patient's stomach prior to endotracheal intubation. Approximately 1 L of bilious gastric content was immediately evacuated, the patient clinically improved, and intubation was avoided. A repeat

Figure 2 – Chest radiograph (postoperative day 9 post-nasogastric tube placement) demonstrating a newly placed nasogastric tube descending through the gastric conduit (gastric pull-up) and projecting within the medial aspect of the left hemithorax, unchanged moderate left hydropneumothorax, decreased left lower lobe atelectasis, unchanged right lower lung consolidation, and persistent dilated bowel loops.

portable chest radiograph confirmed NGT position, and the stomach appeared to be decompressed (Fig 2).

It is likely that the patient's grossly distended stomach interfered with her respiratory function, which had already been compromised by pneumonia. Rapid identification of the gastric contents within the chest by POCUS permitted decompression of the gastric contents and mitigated the need for emergent endotracheal intubation with its attendant risk for aspiration. Postprocedural POCUS examinations must take into account surgical anatomic changes that may differ markedly from the native anatomy from which the POCUS clinician was trained.⁶

Reverberations

1. *Gastric POCUS can be easily and quickly performed peri-intubation to assess for large volume gastric content in patients who have not been fasting peri-intubation or who have surgical procedures or other conditions that cause delayed gastric emptying.*
2. *NGT decompression should be performed on patients with large volume gastric content to decrease the likelihood of PIA.*
3. *Limitations of gastric POCUS, such as the possibility of false-negative examinations in certain conditions, should be recognized. POCUS examination findings should be correlated with clinical findings, pre-POCUS surgical procedures, and clinical judgment.*

4. *In clinical situations where the anatomy is surgically altered, POCUS may be a superior diagnostic tool than portable radiograph because it allows the clinician to view structures in multiple planes and to better differentiate between liquid and solid structures.*

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Additional information: The Videos can be found in the Supplemental Materials section of the online article.

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